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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,438	06/26/2001	James L. Foran	15-4-1152.00	9657

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STERNE, KESSLER, GOLDSTEIN & FOX PLLC
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER	
YANG, RYAN R	

ART UNIT	PAPER NUMBER
2672	9

DATE MAILED: 06/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/888,438	Applicant(s) FORAN, JAMES L.	
	Examiner Ryan R Yang	Art Unit 2672	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 April 2004* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *8* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114.

2. This action is responsive to communications: Request for reconsideration, filed on 4/1/2004. This action is non-final.

3. Claims 1-11 are pending in this application. Claims 1 and 9 are independent claims.

4. This application claims benefit of 60/219,006 dated 7/18/2000.

5. The present title of the invention is "Method and system for presenting three-dimensional computer graphics images using multiple graphics" as filed originally.

Claim Rejections - 35 USC § 103

6. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

7. Claims 1-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knittel et al. (6,532,017) and further in view of Kelleher (5,794,016).

As per claim 1, Knittel et al., hereinafter Knittel, discloses a method for presenting three-dimensional computer graphics images using multiple graphics processing units, comprising the steps of:

(1) allocating, to each GPU, three-dimensional computer graphics data such that said allocated three-dimensional computer graphics data correspond to a portion of the scene that lies within the rectangular subvolume to which that GPU has been assigned (Figure 7 V-Bus to 210 "The VRC 202 includes a pipelined processing element 210 having 4 parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipeline has the functions of a GPU);

(2) rendering, by each of the GPUs, said allocated three-dimensional computer graphics data (where each pipeline can perform "interpolation, classification, gradient estimation, illumination, and compositing", Abstract);

(3) combining said rendered three-dimensional computer graphics data, thereby producing a three-dimensional computer graphics image (Figure 4 29 "the colors, levels of brightness, and transparencies assigned to all of the samples along all of the rays are applied as illustrated at 29 to a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32 for display on image plane 16", column 9, line 34-40); and

(4) presenting, for viewing, said combined three-dimensional computer graphics image (Figure 4 32).

Knittel discloses a method for presenting three-dimensional computer graphics images using multiple graphics processing units. It is noted that Knittel does not explicitly disclose "wherein said allocated computer graphics data that correspond to the portion of the scene includes at least one of first data for a first graphics primitive having first vertices that lie within the rectangular volume to which that GPU has been assigned and second data for a second graphics primitive having a vertex that lies outside of the rectangular subvolume to which that GPU has been assigned", however, this is known in the art as taught by Kelleher. Kelleher discloses a graphics processing method in which triangles visible to both blocks are sent to both processors for processing (column 8, line 37-51).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Kelleher into Knittel because Knittel discloses a method of multi-processing a 3-D image and Kellerher discloses the primitive vertex information outside of a subvolume can be included in subvolume processing in order to increase processor efficiency.

8. As per claim 2, Knittel and Kellerher demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Knittel further discloses said allocating further comprises loading, into a memory cell accessible by that GPU, the three-dimensional computer graphics data corresponding to a portion of the scene that lies within the rectangular subvolume to which that GPU has been assigned (Figure 6 204 "section memory 204 is used to store sections of a volume during rendering of the

volume data set by the VRC", column 14, line 47-48 and Fig. 10 depicts loading of the subvolume to memory).

9. As per claim 3, Knittel and Kellerher demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Knittel further discloses, before step (2), the steps of:

(5) determining a viewing position (Figure 1 depicts selecting a viewing direction); and

(6) communicating said determined viewing position to each GPU ("A first interpolation unit 244 interpolates the z-gradient in the z direction, resulting in four intermediate values", column 12, line 64-66, therefore, the viewing direction is known by the GPU).

10. As per claim 4, Knittel and Kellerher demonstrated all the elements as applied to the rejection of dependent claim 3, supra, and Knittel further discloses said combining further comprises the step of:

(7) ordering said rendered three-dimensional computer graphics data based on locations between said determined viewing position and each rectangular subvolume (Figure 10 shows the subvolume is ordered into DRAM).

11. As per claim 5, Knittel and Kellerher demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Knittel further discloses said combining further comprises the step of:

(8) blending said rendered three-dimensional computer graphics data (Figure 4 29 "a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32", column 9, line 36-39).

12. As per claim 6, Knittel and Kellerher demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Knittel further discloses said combining is performed by at least one image combiner (Figure 5A 124 where Figure 5A is a block diagram of a pipeline).

13. As per claim 7, Knittel and Kellerher demonstrated all the elements as applied to the rejection of dependent claim 6, supra, and Knittel further discloses each of the at least one image combiner has an associated frame buffer for storing said combined three-dimensional computer graphics image (Figure 14 200 where the pixel memory stores said combined three-dimensional computer graphics image).

14. As per claim 8, Knittel and Kellerher demonstrated all the elements as applied to the rejection of dependent claim 6, supra, and Knittel further discloses an output of the at least one image combiner is an input for another image combiner (Figure 14 where the output of 124 Compositing is output to Slice FIFO, to 250 Ray Shift Register, through MUX, then to next Compositing Unit).

15. As per claim 9, Knittel discloses a system for presenting three-dimensional computer graphics images using multiple graphics processing units, comprising:

memory for storing three-dimensional computer graphics data (Figure 14 100);

at least one GPU for rendering a portion of the three-dimensional computer graphics data that corresponds to a rectangular subvolume to which said at least one

GPU is assigned to a rectangular subvolume (Figure 7 V-Bus to 210 "The VRC 202 includes a pipelined processing element 210 having 4 parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipeline has the functions of a GPU and each rendering pipeline renders a volume of voxel);

a communications means for communicating a viewing position to each of said at least one GPU ("A first interpolation unit 244 interpolates the z-gradient in the z direction, resulting in four intermediate values", column 12, line 64-66, therefore, the viewing direction is known by the GPU); and

at least one image combiner for combining the three-dimensional computer graphics data rendered by said at least one GPU, to produce a three-dimensional computer graphics image (Figure 14 has a plurality of Compositing Unit);

Knittel discloses a system for presenting three-dimensional computer graphics images using multiple graphics processing units. It is noted that Knittel does not explicitly disclose "wherein said portion of the three-dimensional computer graphics data includes at least one of first data for a first graphics primitive having first vertices that lie within the rectangular volume to which said at least one GPU is assigned and second data for a second graphics primitive having a vertex that lies outside of the rectangular subvolume to which said at least one GPU is assigned", however, this is known in the art as taught by Kelleher. Kelleher discloses a graphics processing method in which triangles visible to both blocks are sent to both processors for processing (column 8, line 37-51).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Kelleher into Knittel because Knittel discloses a method of multi-processing a 3-D image and Kellerher discloses the primitive vertex information outside of a subvolume can be included in subvolume processing in order to increase processor efficiency.

16. As per claim 10, Knittel and Kellerher demonstrated all the elements as applied to the rejection of independent claim 9, supra, and Knittel further discloses said memory is memory cells such that each said memory cell is accessible by only one of said at least one GPU ("The voxels are supplied to the pipelines 210-0- 212-3, respectively, in 4-voxel groups in a scanned order", column 15, line 9-11).

17. As per claim 11, Knittel and Kellerher demonstrated all the elements as applied to the rejection of independent claim 9, supra, and Knittel further discloses wherein at least one of said at least one image combiner is configured to receive the output of at least one other of said at least one image combiner (Figure 14 where the output of 124 Compositing is output to Slice FIFO, to 250 Ray Shift Register, through MUX, then to next Compositing Unit).

Response to Arguments

18. Applicant's arguments with respect to claims 1-11 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Inquiries

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Ryan Yang** whose telephone number is **(703) 308-6133**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Michael Razavi**, can be reached at **(703) 305-4713**.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 305-47000377.

Ryan Yang
June 6, 2004